NEST USURPATION OF *VESPULA VULGARIS* BY *DOLICHOVESPULA ARENARIA* WITH SUCCESSIVE PARASITISM OF *D. ARENARIA* BY *D. ARCTICA* (HYMENOPTERA: VESPIDAE)[1,2]

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ABSTRACT: A nest containing three species of Vespinae was studied in upstate New York. The nest was probably established by *Vespula vulgaris* (L.). *Dolichovespula arenaria* (F.) was evidently acting as a temporary parasite of *V. vulgaris,* thus representing the first case of intergeneric social parasitism in the Vespidae. *D. arctica* (Rohwer) was acting as a permanent parasite of *D. arenaria.* The atypical nesting habitat — underside of a cliff overhang — undoubtedly facilitated the usurpation of the *V. vulgaris* nest by *D. arenaria.*

Taylor (1939) delineated four forms of social parasitism in the genus *Vespula.* Two of his forms: (1) interspecific, facultative temporary parasitism; and, (2) interspecific, obligatory permanent parasitism, pertain to a nest we studied in northern New York. The first situation occurs when established nests are invaded by queens of different species; the invading queen lays her eggs and the host workers rear them. The second situation develops when a species evolutionarily loses its worker caste and must depend upon another species to rear its reproductive young. Both forms of parasitism are characterized by individuals of different species cohabitating a nest simultaneously. Both forms of social parasitism apparently existed concurrently in a nest we observed.

The nest was found on the underside of a cliff overhang in a gravel pit at the SUNY-CESF Cranberry Lake Biological Station, St. Lawrence County, NY. It was situated in soil adjacent to the root system of a decaying tree. We observed the nesting activity for several hours on July 21 and 24, 1980 before removing the nest for close inspection. The nest was 6.0 cm diam. and 5.5 cm tall. It consisted of two combs, an upper one with a diameter of 2.2 cm and containing 47 cells, and a lower tier with a diameter of 3.3 cm and containing 91 cells. The upper comb contained a small central core of tan cells. A four-layer, light grey paper envelope covered the nest. One *Vespula vulgaris* (L.) worker, 9 *Dolichovespula arenaria* (F.) workers, 1 *D. arenaria* queen, and 1 *D. arctica* (Rohwer) queen were located inside the nest.

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The nest was probably initiated by *V. vulgaris*. Spadberry (1973) described *V. vulgaris* nests as being distinctly brittle and tan or red-brown in color. The presence of a central core of tan cells in the upper comb tier agrees with this description (see Akre *et al.* 1977). The subsequent addition of the grey-colored combs and envelope indicates that *D. arenaria* usurped the nest at an early stage.

The location of the nest also points to *V. vulgaris* as the original foundress. Balduf (1968) reported that the preferred nesting site for *V. vulgaris* is thoroughly decayed wood. Bequaert (1931) noted that this species almost always builds underground or in well-sheltered spots. *D. arenaria,* on the other hand, is an aerial nester, although it occasionally nests subterraneously (Greene *et al.* 1976; Roush and Akre 1978).

The *D. arctica* queen probably entered the nest shortly after the invasion by *D. arenaria. D. arctica* has been observed attempting to take over nests which are already parasitized (Evans 1975; Jeanne 1977). If such is the case, then this nest would represent a succession of parasitism, with *D. arenaria* acting as a temporary parasite of *V. vulgaris* and *D. arctica* acting as a permanent parasite of *D. arenaria.*

A *D. arctica* queen and a *D. arenaria* queen may live together harmoniously in the same nest for some time (Wheeler and Taylor 1921; Taylor 1939; Evans 1975; Jeanne 1977; Greene *et al.* 1978). Such a *D. arctica* queen depends upon the host workers to raise her brood. In the case of the nest we observed it would be the "secondary" host workers.

The absence of a *V. vulgaris* queen may be accounted for in two ways. The *V. vulgaris* queen may have died of natural causes. Alternately, the *V. vulgaris* queen may have been killed or displaced, probably by the *D. arenaria* female. Since the nest was collected at dusk, it is unlikely that she was in the field. Colonies that have lost their own queen will accept an invading one, in this case even of another genus.

There are no reports on aggressive behavior in intergeneric invasions. However, aggressive behavior by invading, interspecific, parasitic vespids is common. Inter- and intraspecific usurpations occur regularly between *Dolichovespula* queens but normally go unnoticed (Edwards 1982). MacDonald and Matthews (1975) found *V. squamosa* (Drury) parasitizing the nest of *V. maculifrons* (Buysson) via elimination of the host queen. Reed *et al.* (1979) and Reed and Akre (1983) noted that a *V. austriaca* (Panzer) queen will parasitize *V. rufa* (L.) and *V. acadica* (Sladen) nests, respectively, kill the host queen, and act aggressively toward the host workers.

On July 24 we found two dead *D. arenaria* workers directly beneath the entrance to the nest. Later, three larval vespids were observed being thrown out and two of them were alive. Greene *et al.* (1978) described similar behavior occurring during periods of colony instability, such as after the death of the host queen. The discarded larvae may have represented the last

of the *V. vulgaris* brood. The parasitic invasions, coupled with the elimination of the *V. vulgaris* queen, may have led to colony instability and the eventual discarding of apparently healthy larvae.

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